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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Art Unit	:	1774
Examiner	:	Lawrence D. Ferguson
Applicants	:	Johannes Stollenwerk et al.
Appln. No.	:	09/686,417
Filed	:	October 11, 2000
Confirmation No.	:	6074
For	:	CONDUCTIVE TRANSPARENT LAYERS AND A METHOD FOR THEIR PRODUCTION

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Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

APPELLANT'S BRIEF (37 CFR §1.192)

This brief is in furtherance of the Notice of Appeal, filed in this case on May 1, 2003.

The fees required under §1.17(f), and any required petition for extension of time for filing this brief and fees therefor, are dealt with in the accompanying TRANSMITTAL OF APPEAL BRIEF.

This brief is transmitted in triplicate. (37 CFR §1.192(a)).

This brief contains these items under the following headings, and in the order set forth below (37 CFR §1.192(c)):

I. Real Party in Interest

II. Related Appeals and Interferences

III. Status of Claims

IV. Status of Amendments

V. Summary of Invention

VI. Issues

VII. Grouping of Claims

VIII. Arguments

IX. Conclusion

Appendix of Claims Involved in the Appeal

The final page of this brief bears the attorney's signature.

I. Real Party in Interest

The real party in interest in this application is BPS Alzenau GmbH, 63754 Alzenau GmbH Germany.

II. Related Appeals and Interferences

There are not any related appeals or interferences which will directly affect, or be directly affected by, or have a bearing on, the Board's Decision in this Appeal.

III. Status of Claims

This is an Appeal from the rejection of claims 1-11 and 21-25. Claims 12-20 have been cancelled.

IV. Status of Amendments

The rejection of claims 1-11 and 21-25 is being appealed after a Final Rejection of these claims. Amendments to the claims were not submitted in response to the Final Rejection. Claims 1, 3-11 and 21-25 read as amended in Amendment A, submitted March 13, 2002, and the remaining claim 2 reads as originally filed.

V. Summary of the Invention

Appellants have discovered a process for making an improved conductive transparent layer system having two oxide layers and a silver layer interposed between the oxide layers. The improved conductive transparent layer system is characterized by a very low surface resistivity in combination with a relatively high mean Haacke quality factor. Thus, the claimed system exhibits an excellent, heretofore unachieved, combination of optical transmittance and electrical conductivity. This <u>combination of properties</u> is extremely useful and desirable for the production of high quality display devices and optoelectronic devices. It was known that improved optical transmittance could be achieved by using a thinner silver layer. However, this causes an undesirable decrease in electrical conductivity. Similarly, it was known that improved electrical conductivity could be achieved by increasing the thickness of the silver layer. However, this causes an undesirable decrease in optical transmittance. Thus, there was an art recognized

tradeoff between electrical conductivity and optical transmittance. In general, any improvement (increase) in optical transmittance would result in an undesirable decrease in electrical conductivity, and any improvement in electrical conductivity (decrease in surface resistivity) would result in an undesirable decrease in optical transmittance. Improvements in electrical conductivity have also generally produced thicker conductive transparent layer systems that require more time to etch and which exhibit low resolution due to excessive undercutting during etching. An art recognized need existed for conductive transparent layer systems that <u>simultaneously</u> exhibit a <u>combination</u> of lower surface resistivity and high optical transmittance. These improvements were desired to facilitate manufacture of high quality, high resolution (high pixel count) LCD display devices with screen diagonals over seventeen inches. The invention fulfills this need by providing a conductive transparent layer system that exhibits <u>both</u> a surface resistivity less than 2.9_{sq} <u>and</u> a mean Haacke quality factor (for wavelengths of 435, 545 and 610 nm) that is greater than 0.085^{-1}.

VI. Issue

The only issue under consideration in this Appeal is whether claims 1-11 and 21-25 are unpatentable under 35 U.S.C. §103(a) based on the teachings of Depauw et al. (U.S. Patent No. 5,110,662) in view of U.K. Patent Application GB 2126256 A, and further in view of Appellants' admission.

VII. Grouping of Claims

For purposes of this Appeal only, all of the claims (1-11 and 21-25) currently pending and under consideration in this application will stand or fall together.

VIII. Arguments

A. The Rejection

Claims 1-11 and 21-25 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Depauw et al. (U.S. Patent No. 5,110,662) in view of U.K. Patent Application GB 2126256 A and in further view of Appellants' admission. The Examiner has admitted that the

Depauw et al. patent does not disclose a conductive transparent layer system having either the required surface resistivity or the required mean Haacke quality factor. The Examiner has however, stated that the Depauw et al. patent "explicitly teaches how to adjust the surface resistivity as desired." The Examiner has further noted that Appellants have stated in the specification (page 2, lines 24-27) that "it is also known that through selective choice of materials and coating parameters, transparent conductive layer systems can be produced which have a resistivity of 2.93_{sq}." Despite the absence of any relevant teaching, the Examiner concluded that "Since Depauw teaches how to adjust the surface resistivity and applicant acknowledges that it is known how to arrive at the required values, applicant's invention would be obvious to one of ordinary skill in the art."

The Examiner has stated that the UK Patent Application (GB '256) discloses a conductive transparent layer system that has "good transmittance in the visible light range, especially in the 370-780 nm wavelength" range, and that "weight percentage [of certain elements in the layers] has a direct effect on the transparency and is therefore optimizable as taught by GB '256."

Thus, while neither of the applied references discloses a conductive transparent layer system having either of the required characteristics for surface resistivity and mean Haack quality factor, or how to achieve both characteristics simultaneously, the Examiner has concluded that the claimed invention would have been obvious to one having ordinary skill in the art. The Examiner's reasoning reads in its entirety as follows:

> It would have been obvious to one of ordinary skill in the art to include the cerium oxide with the indium oxide and the copper with the silver in the layer system of Depauw to sustain the conductivity of the layer system. It would have additionally be obvious to one of ordinary skill in the art to include the wavelength ranges taught by GB '256 in the multilayered system of Depauw because both references have high transmittances and GB '256 further supports this feature by teaching the wavelengths for the high transmittance. Neither reference disclosed the transparency value as disclosed by applicant. Because the combined features contain the same materials as applicant, the transparency value would be expected to be the same, absent any evidence to the contrary.

B. The Depauw Et Al. Patent

The Depauw et al. patent discloses multiple layer glazing material, including widow glazing panels and vehicle window panels. The disclosed glazing materials include a multiple layer coating "comprised of a reflective layer of silver sandwiched between a transparent undercoat and a transparent overcoat," wherein both the transparent undercoat and the transparent overcoat are metal oxide layers. However, as admitted by the Examiner, the Depauw et al. patent does not teach a conductive transparent layer system having the required surface resistivity of less than 2.9_{sq} <u>and</u>, in <u>combination</u>, the required mean Haacke quality factor of greater than 0.085^{-1}. The disclosed embodiments (Examples I-III, at best, have a mean Haacke quality factor of about 0.03 ($.87^{10}/8$). This value is considerably less than the required mean Haacke quality factor "greater than 0.085^{-1}."

The Examples disclose that it might be desirable "to reduce the resistivity to about 4 ohms per square," and that this "can readily be done by increasing the thickness of that [silver] layer to 12 nm." If one were to reduce the resistivity to about 4 ohms per square as suggested, without affecting optical transmissivity, then the resulting mean Haacke quality factor would be about 0.06. This is still considerably less than the required mean Haacke quality factor which must be "greater than 0.085^{-1}." However, increasing the thickness of the silver layer will cause a substantial decrease in the optical transmittance, which in turn will greatly <u>reduce</u> the mean Haacke quality factor.

Thus, it is respectfully submitted that the Depauw et al. reference fails to suggest a conductive transparent layer system exhibiting <u>both</u> of the required characteristics for surface resistivity and mean Haacke quality factor. In fact, it does <u>not</u> suggest a conductive transparent layer system having <u>either</u> of the required characteristics. While the reference teaches embodiments having a resistivity of about 8 ohms per square, and suggests the desirability of reducing the resistivity to about 4 ohms per square, the reference does not teach or suggest the desirability of a surface resistivity "of less than 2.9_{sq}," as required by the pending claims. Further, there is not any teaching or suggestion as to how one might be able to simultaneously reduce surface resistivity without also reducing optical transmittance, which results in an

undesirably mean Haacke quality factor. In fact, the Depauw et al. reference does not even hint at the desirability of achieving the required combination of characteristics.

C. U.K. Patent Application GB 2126256 A

The GB '256 patent application discloses a visible light transparent heatwave shield coating comprising a metallic film (that may be composed of silver) disposed between dielectric layers (that may be metal oxide layers). As admitted by the Examiner, the GB '256 patent application does not disclose the required conductive transparent layer system having both a surface resistivity of less than 2.9_{sq} and a mean Haacke quality factor greater than 0.085^{-1}. In fact, at best, the GB '256 patent application discloses a coating having a transmittance "reaching up to 91% at the wavelength of 500 nm," and a resistivity of about 3.3 (see page 1, lines 77-90). This corresponds to a mean Haacke quality factor of about 0.118 at 500 nm. However, the GB '256 patent application does not disclose a conductive transparent layer system having the required surface resistivity "of less than 2.9_{sq}" or the required mean Haacke quality factor at each of the wavelengths 435, 545 and 610 nm. Further, there is not any teaching or suggestion as to how one would go about reducing the surface resistivity to less than 2.9_{sq}, while maintaining a mean Haacke quality factor greater than 0.085^{-1} at each of the wavelengths 435, 545 and 610 nm. Finally, the GB '256 patent application does not provide any motivation for reducing the surface resistivity to less than 2.9_{sq} and/or maintaining a mean Haacke quality factor greater than 0.085^{-1} at each of the wavelengths 435, 545 and 610 nm.

D. Appellants' Admission

As stated by the Examiner, Appellants did admit that it was known to select materials and coating parameters to produce a conductive layer system having a surface resistivity of 2.93_{sq}. This admission is irrelevant. The claims require a system having both a surface resistivity of less than 2.9_{sq} (2.93_{sq} is not less than 2.9_{sq}) and, at the same time, a mean Haacke quality factor greater than 0.085^{-1} at each of the wavelengths 435, 545 and 610 nm.

E. Discussion Of The Rejection In View Of The Applied References And Admission

Neither of the applied references (or Appellants' admission) teach or suggest the claimed system having the required combination of characteristics relating to surface resistivity and mean Haacke quality factor. This is admitted by the Examiner. In fact, the Depauw et al. patent does not disclose any embodiment having either the required surface resistivity or the required mean Haacke quality factor at any wavelength. Further, the Depauw et al. patent does not disclose any reason, i.e., does not provide motivation, for simultaneously decreasing the surface resistivity to less than 2.9_{sq} and raising the mean Haacke quality factor so that it is greater than 0.085^{-1}, as required by the claims. While, as noted by the Examiner, the Depauw et al. patent "teaches how to adjust the surface resistivity," the Depauw et al. patent does not provide motivation for simultaneously reducing the surface resistivity to the required value of less than 2.9_{sq}, while increasing the mean Haacke quality factor to the required value of greater than 0.085^{-1} at each of the wavelengths 435, 545 and 610 nm. The only technique disclosed by Depauw et al. patent for adjusting the surface resistivity involves increasing the thickness of the electrically conductive metal layer. While increasing the thickness of the conductive metal layer will reduce surface resistivity, it will also reduce optical transmittance and reduce the mean Haacke quality factor. Thus, if one starts with a conductive transparent layer system as disclosed by the Depauw et al. patent (i.e., a system which meets neither of the required characteristics), and adjusts the surface resistivity as disclosed by the Depauw et al. patent, by increasing the thickness of the electrically conductive layer, the result must necessarily be a system that fails to meet the requirement for the mean Haacke quality factor, regardless of the value to which the surface resistivity has been reduced. Bear in mind that mean Haacke quality factor is many more times dependent on optical transmittance than surface resistivity (mean Haacke quality factor is proportional to optical transmittance to the tenth power and only inversely proportional to surface resistivity). Any minor effect on mean Haacke quality factor brought about by reducing surface resistivity by increasing the thickness of the electrically conductive layer would be overwhelmed by the decrease in optical transmittance. Thus, the Depauw et al. patent not only fails to teach, suggest

or provide motivation for the claimed invention, but also fails to teach or suggest a technique useful for simultaneously reducing surface resistivity and increasing mean Haacke quality factor.

The Examiner has also based the rejection on the mistaken belief that Appellants' have acknowledged that it is known how to arrive at the required values. An admission that it was known to achieve a surface resistivity of 2.93_{sq} is not an admission that those having ordinary skill in the art knew how to achieve the required surface resistivity of less than 2.9_{sq} in combination with the required mean Haacke quality factor of greater than 0.085^{-1} at each of the required wavelengths (435, 545 and 610 nm).

Although the Examiner has rejected each of the claims as being unpatentable over Depauw et al. in view of the GB '256 patent application and in further view of Appellants' admission, Appellants' admission is irrelevant and the Examiner has not explained how the GB '256 patent application provides any teaching or suggestion that would motivate those having ordinary skill in the art to modify the layer system described in the Depauw et al. patent so that it meets the requirements of the claims. Specifically, the Examiner has stated that it would have been obvious to one having ordinary skill in the art to "include the cerium oxide with the indium oxide and the copper with the silver in the layer system of Depauw to sustain the conductivity of the layer system," and "to include the wavelength ranges taught by GB '256 in the multilayered system of Depauw because both references have high transmittances and GB '256 further supports this feature by teaching the wavelengths for the high transmittance." None of this explains how the teachings of the GB '256 patent relate to the broader aspects of the invention. In particular, the Examiner has not explained how the GB '256 patent application provides motivation for modifying the systems described in the Depauw et al. patent so that they meet the required characteristics for surface resistivity and mean Haacke quality factor as recited in claim 1.

The Examiner has also suggested that the combined references somehow teach the claimed conductive transparent layer system having the required combination of characteristics relating to surface resistivity and mean Haacke quality factor because "the combined references

contain the same materials as applicant, the transparency value would be expected to be the same, absent any evidence to the contrary." As explained in the specification, the claimed combination of surface resistivity and mean Haacke quality factor is not merely the result of selecting suitable materials. To the contrary, as disclosed in the specification, the required combination of characteristics is achieved by way of an improved process that is neither taught nor suggested by the prior art. In particular, the properties of the layer system of the present invention are achievable as a result of a new production process in which a first oxide layer is deposited on the substrate, a silver layer is deposited on the first oxide layer and a second oxide layer is deposited on the silver layer by means of pulsed DC-sputtering or AC-superimposed DC-sputtering. This production technique leads to higher carrier densities and higher carrier mobilities in the sputtered oxide films which in turn improves the optical properties of the oxide layers. The applied references do not teach or suggest the production parameters that may be utilized to simultaneously achieve the required characteristics or surface resistivity and mean Haacke quality factor. Moreover, the applied references expressly state that the disclosed embodiments do not have the required surface resistivity. Principles of inherency do not apply when the prior art only discloses embodiments that fail to meet the requirements of the claims.

One having ordinary skill in the art would not find any suggestion in the prior art for a suitable process for producing the claimed conductive transparent layer systems having the required combination of surface resistivity and mean Haacke quality factor. Instead, when one combines the teachings of the applied reference, the result is a system that fails to meet the required surface resistivity, the mean Haacke quality factor, or both. Thus, the prior art fails to teach or suggest the claimed invention, fails to disclose the desirability (i.e., motivation) for the claimed invention, and fails to disclose a suitable process for preparing a conductive transparent layer system as claimed.

IX. Conclusion

For the reasons set forth above, and as is apparent from consideration of the applied references, the claims at issue are patentable, such that reversal of the rejection is proper.

Respectfully submitted,

JOHANNES STOLLENWERK ET AL.

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Appendix of Claims (37 CFR §1.192(c)(9))

1. A conductive transparent layer system with two oxide layers and a silver layer interposed therebetween on a substrate, characterized in that with a surface resistivity R_s of less than 2.9_{sq}, the mean Haacke quality factor ($\Phi_{TC} = T^{10}/R_s$) of the layer system for the wavelengths 435, 545 and 610 nm is greater than 0.085^{-1}.

2. The layer system of claim 1, characterized in that with a surface resistivity of 2.5 $_{sq}$, the transparency T at 435 nm is at least 89%, at 545 nm at least 88% and at 610 nm at least 75%.

3. The layer system according to claim 3, characterized in that the layer system is less than 100 nm thick, with the silver layer being less than 20 nm thick, and the two oxide layers being less than 50 nm thick.

4. The layer system according to claim 3, characterized in that the oxide layers contain about 90-95% indium and about 5-10% cerium.

5. The layer system according to claim 4, characterized in that the silver layer contains up to 10 wt.% copper.

6. The layer system according to claim 1, characterized in that the layer system is less than 100 nm thick, with the silver layer being less than 20 nm thick, and the two oxide layers being less than 50 nm thick.

7. The layer system according to claim 6, characterized in that the oxide layers contain about 90-95% indium and about 5-10% cerium.

8. The layer system according to claim 7, characterized in that the silver layer contains up to 10 wt.% copper.

9. The layer system according to claim 1, characterized in that the oxide layers contain about 90-95% indium and about 5-10% cerium.

10. The layer system according to claim 9, characterized in that the silver layer contains up to 10 wt.% copper.

11. The layer system according to claim 1, characterized in that the silver layer contains up to 10 wt.%.

21. The layer system according to claim 1 in which the second oxide layer is deposited by means of pulsed DC sputtering or AC-superimposed DC sputtering.

22. The layer system of claim 1, characterized in that the frequency of the superimposed AC is between 1 and 50 MHz.

23. The layer system of claim 1, characterized in that the AC component, defined by the ratio of the DC and AC power supplies, is between 10-90%.

24. The layer system of claim 1, characterized in that the total power density (AC and DC) is in the range from 1-3 W/cm^2.

25. The layer system of claim 1, characterized in that magnetron sputtering is chosen as sputtering method.